

REMARKS

Claims 37-83 are pending in the present application. Claims 37, 41, 51, and 67 have been amended in this response. More specifically, claim 51 has been amended to correct a typographical error without narrowing the scope of this claim.

In the Office Action dated October 6, 2005, claims 37, 38, 40, 41, 43, 44, 49-51, 56, 57, 60, 62, 67, 69, 74, 75, and 77 were rejected. More specifically, the status of the claims in light of this Office Action is as follows:

(A) Claims 37, 38, 40, 41, 43, 44, 49-51, 56, 57, 60, 62, 67, 69, 74, 75, and 77 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,352,318 to Takabayashi et al. ("Takabayashi");

(B) Claims 39, 42, 45-48, 52-55, 58, 59, 61, 63-66, 68, 70-73, and 76 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form to include the features of the claims from which they depend; and

(C) Claims 78-83 were allowed.

A. Response to the Section 102(b) Rejection over Takabayashi

Claims 37, 38, 40, 41, 43, 44, 49-51, 56, 57, 60, 62, 67, 69, 74, 75, and 77 were rejected under 35 U.S.C. § 102(b) as being anticipated by Takabayashi. As described below, Takabayashi fails to disclose or suggest all of the features of these claims.

- (1) Claim 37 is Directed to a Method for Disposing Underfill on a Microelectronic Device Including, *inter alia*, Covering at Least a Portion of the Electrical Couplers that Project from Pads on the Device

Claim 37 is directed to a method for disposing underfill on a microelectronic device having a plurality of pads and a plurality of electrical couplers projecting from corresponding pads. The method includes flowing an underfill material including a plurality of electrically charged filler elements onto the microelectronic device and covering at least a portion of the electrical couplers.

(2) Takabayashi Discloses a Method for Electrically Connecting the Terminals of a Semiconductor Device to the Terminals of a Substrate with a Plurality of Electroconductive Particles

Takabayashi discloses a method for electrically connecting the terminals of a semiconductor device to the terminals of a substrate with a plurality of electroconductive particles. The method includes charging the electroconductive particles and drawing the charged particles toward the terminals of the substrate by connecting a grounding line to the terminals. After the particles are deposited onto the terminals of the substrate, the semiconductor device is attached to the substrate with the terminals of the device contacting the electroconductive particles, and an insulating adhesive is introduced into the gap between the substrate and the device. One object of Takabayashi's invention is to connect a semiconductor device "to a circuit substrate without forming bump contacts on the semiconductor device." (Takabayashi 2:7-9.)

(3) Takabayashi Fails to Disclose or Suggest a Method for Disposing Underfill on a Microelectronic Device Including, *inter alia*, Covering at Least a Portion of the Electrical Couplers that Project from Pads on the Device

Takabayashi fails to disclose or suggest a method for disposing underfill on a microelectronic device including, *inter alia*, "flowing an underfill material including a plurality of electrically charged filler elements onto the microelectronic device and covering at least a portion of the electrical couplers" that "project[] from corresponding pads" on the device, as recited in claim 37. Applicants do not concede to the characterization of Takabayashi in the Office Action, but even if Takabayashi's electroconductive particles correspond to the electrically charged filler elements of claim 37 as suggested by the Examiner, then Takabayashi does not disclose electrical couplers that project from pads on his device. The only component that projects from Takabayashi's device is the electroconductive particles, and Takabayashi's electroconductive particles cannot correspond to both the electrically charged filler elements of the underfill material and the electrical couplers of the microelectronic device in claim 37. Moreover, one skilled in the art would not be motivated to modify Takabayashi's device and add electrical couplers because such a modification would frustrate one purpose of Takabayashi's invention. Specifically, one object of

Takabayashi's invention is to connect a semiconductor device "to a circuit substrate without forming bump contacts on the semiconductor device." (Takabayashi, 2:7-9; emphasis added.) Consequently, Takabayashi fails to disclose or suggest "covering at least a portion of the electrical couplers" that "project[] from corresponding pads" on the device, as required by claim 37. Therefore, the Section 102(b) rejection of claim 37 should be withdrawn.

Claims 38 and 40 depend from claim 37. Accordingly, the Section 102(b) rejection of claims 38 and 40 should be withdrawn for at least the reasons discussed above with reference to claim 37 and for the additional features of these claims.

- (4) Claim 41 is Directed to a Method for Disposing Underfill Material on a Microelectronic Device Including, *inter alia*, Applying an Electric Field to the Underfill Layer to Manipulate at Least a Portion of the Electrically Charged Filler Elements After Depositing the Underfill Layer

Claim 41 is directed to a method for disposing underfill material on a microelectronic device having a plurality of electrical couplers. The method includes depositing an underfill layer onto the microelectronic device and covering at least a portion of the electrical couplers. The underfill layer comprises a binder and a plurality of electrically charged filler elements in the binder. The method further includes applying an electric field to the underfill layer to manipulate at least a portion of the electrically charged filler elements after depositing the underfill layer.

- (5) Takabayashi Fails to Disclose or Suggest a Method for Disposing Underfill Material on a Microelectronic Device Including, *inter alia*, Applying an Electric Field to the Underfill Layer to Manipulate at Least a Portion of the Electrically Charged Filler Elements After Depositing the Underfill Layer

Takabayashi fails to disclose or suggest a method for disposing underfill material on a microelectronic device including, *inter alia*, "applying an electric field to the underfill layer to manipulate at least a portion of the electrically charged filler elements after depositing the underfill layer," as recited in claim 41. Rather, Takabayashi discloses applying an electric field while depositing the underfill layer. Specifically, Takabayashi's method includes applying an electric field to charge the electroconductive particles and

urge the particles toward the terminals on the substrate. Takabayashi does not disclose applying an electric field to manipulate the electroconductive particles after placing the electroconductive particles on the terminals and introducing the insulating adhesive into the gap between the substrate and the semiconductor device. Moreover, one skilled in the art would not be motivated to modify Takabayashi's method and apply an electric field to manipulate the electroconductive particles after depositing the particles and adhesive because such a modification may render Takabayashi's device inoperable. Specifically, if an electric field were applied to the electroconductive particles after depositing the particles and adhesive, the particles may detach from the terminals and, consequently, fail to provide an electrical connection between the substrate and the semiconductor device. Accordingly, Takabayashi fails to disclose or suggest "applying an electric field to the underfill layer to manipulate at least a portion of the electrically charged filler elements after depositing the underfill layer," as required in claim 41. Therefore, the Section 102(b) rejection of claim 41 should be withdrawn.

Claims 43, 44, 49, and 50 depend from claim 41. Accordingly, the Section 102(b) rejection of claims 43, 44, 49, and 50 should be withdrawn for at least the reasons discussed above with reference to claim 41 and for the additional features of these claims.

(6) Claim 51 is Directed to a Method for Disposing Underfill Material on a Microelectronic Device Including, *inter alia*, Moving at Least a Portion of the Electrically Charged Filler Elements Within the Underfill Layer by Applying an Electric Field to the Underfill Layer

Claim 51 is directed to a method for disposing underfill material on a microelectronic device having a plurality of electrical couplers. The method includes covering at least a portion of the electrical couplers of the microelectronic device with an underfill layer containing a matrix and a plurality of electrically charged filler elements, and moving at least a portion of the electrically charged filler elements within the underfill layer by applying an electric field to the underfill layer.

(7) Takabayashi Fails to Disclose or Suggest a Method for Disposing Underfill Material on a Microelectronic Device Including, *inter alia*, Moving at Least a Portion of the Electrically Charged Filler Elements Within the Underfill Layer by Applying an Electric Field to the Underfill Layer

Takabayashi fails to disclose or suggest a method for disposing underfill material on a microelectronic device including, *inter alia*, "moving at least a portion of the electrically charged filler elements within the underfill layer by applying an electric field to the underfill layer," in which the "underfill layer includ[es] a matrix and a plurality of electrically charged filler elements," as recited in claim 51. Applicants do not concede to the characterization of Takabayashi in the Office Action, but even if Takabayashi's electroconductive particles and insulating adhesive correspond to the electrically charged filler elements and the matrix, respectfully, of claim 37, then Takabayashi does not disclose applying an electric field to move the electroconductive particles within the insulating adhesive. Rather, Takabayashi's electroconductive particles are attached to the terminals before the insulating adhesive is introduced into the gap between the device and the substrate. Moreover, as described above with reference to claim 41, one skilled in the art would not be motivated to apply an electric field and manipulate the electroconductive particles after introducing the insulating adhesive because such a modification may render Takabayashi's device inoperable. Consequently, Takabayashi fails to disclose or suggest "moving at least a portion of the electrically charged filler elements within the underfill layer by applying an electric field to the underfill layer," as required by claim 51. Therefore, the Section 102(b) rejection of claim 51 should be withdrawn.

Independent claim 56 has, *inter alia*, features generally analogous to the features of claim 51. Accordingly, the Section 102(b) rejection of claim 56 should be withdrawn for at least the reasons discussed above with reference to claim 51 and for the additional features of claim 56.

Claim 57 depends from claim 56. Accordingly, the Section 102(b) rejection of claim 57 should be withdrawn for at least the reasons discussed above with reference to claim 56 and for the additional features of this claim.

Independent claim 60 has, *inter alia*, features generally analogous to the features of claim 51. Accordingly, the Section 102(b) rejection of claim 60 should be withdrawn for at least the reasons discussed above with reference to claim 51 and for the additional features of claim 60.

Claim 62 depends from claim 60. Accordingly, the Section 102(b) rejection of claim 62 should be withdrawn for at least the reasons discussed above with reference to claim 60 and for the additional features of this claim.

Independent claim 67 has, *inter alia*, features generally analogous to the features of claim 51. Accordingly, the Section 102(b) rejection of claim 67 should be withdrawn for at least the reasons discussed above with reference to claim 51 and for the additional features of claim 67.

Claim 69 depends from claim 67. Accordingly, the Section 102(b) rejection of claim 69 should be withdrawn for at least the reasons discussed above with reference to claim 67 and for the additional features of this claim.

- (8) Claim 74 is Directed to a Method of Underfilling a Microelectronic Device Assembly Including, *inter alia*, Disposing an Underfill Layer so that a Plurality of Filler Elements are Distributed Generally Uniformly Throughout the Underfill Layer

Claim 74 is directed to a method of underfilling a microelectronic device assembly including a microelectronic component, a substrate, and electrical couplers coupling the microelectronic component to the substrate. The method includes disposing an underfill layer including a plurality of electrically charged filler elements between the microelectronic component and the substrate so that the filler elements are distributed generally uniformly throughout the underfill layer.

- (9) Takabayashi Fails to Disclose or Suggest a Method of Underfilling a Microelectronic Device Assembly Including, *inter alia*, Disposing an Underfill Layer so that a Plurality of Filler Elements are Distributed Generally Uniformly Throughout the Underfill Layer

Takabayashi fails to disclose or suggest a method of underfilling a microelectronic device assembly including, *inter alia*, "disposing an underfill layer

including a plurality of electrically charged filler elements . . . so that the filler elements are distributed generally uniformly throughout the underfill layer," as recited in claim 74. For example, Takabayashi's electroconductive particles are not distributed generally uniformly throughout the insulating adhesive. Rather, Takabayashi's electroconductive particles are arranged in clusters between the terminals of the substrate and the terminals of the device. Moreover, one skilled in the art would not be motivated to distribute Takabayashi's electroconductive particles uniformly throughout the insulating adhesive because such a modification would destroy the electrical connection between the substrate and the device and render the assembly inoperable. Consequently, Takabayashi fails to disclose or suggest "disposing an underfill layer including a plurality of electrically charged filler elements . . . so that the filler elements are distributed generally uniformly throughout the underfill layer," as required by claim 74. Therefore, the Section 102(b) rejection of claim 74 should be withdrawn.

Claims 75 and 77 depend from claim 74. Accordingly, the Section 102(b) rejection of claims 75 and 77 should be withdrawn for at least the reasons discussed above with reference to claim 74 and for the additional features of these claims.

B. Response to the Objection to Claims 39, 42, 45-48, 52-55, 58, 59, 61, 63-66, 68, 70-73, and 76

Claims 39, 42, 45-48, 52-55, 58, 59, 61, 63-66, 68, 70-73, and 76 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form to include the features of the claims from which they depend. These claims have not been rewritten in independent form because the rejection of their respective independent claims should be withdrawn for the reasons discussed above.

C. Allowed Claims 78-83

Although the applicants' attorney agrees with the Examiner's conclusion that claims 78-83 are allowable, the applicants' attorney notes that the claims may be allowable for reasons other than those identified by the Examiner and does not

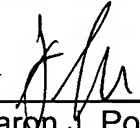
concede that the Examiner's characterization of the terms of the claims and the prior art are correct.

D. Conclusion

In view of the foregoing, the pending claims comply with 35 U.S.C. § 112 and are patentable over the applied art. The applicants accordingly request reconsideration of the application and a Notice of Allowance. If the Examiner has any questions or believes a telephone conference would expedite prosecution of this application, the Examiner is encouraged to call David T. Dutcher at (206) 359-6465.

Respectfully submitted,
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Date: 1/6/06



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